

IN THE CLAIMS

The following is a listing of the claims in accordance with 37 C F R §1.121:

1. (original) A method for multi-modality registration using virtual cursors, the method comprising:
 - receiving a two-dimensional image dataset for an object at a first position;
 - receiving a three-dimensional image dataset for the object at the first position, said three-dimensional image dataset including a plurality of image slices;
 - registering the two-dimensional image dataset with the three-dimensional image dataset without taking into account a magnification factor;
 - receiving a user cursor position for a location in the two-dimensional image dataset;
 - receiving a slice of interest in said three-dimensional image dataset, said slice of interest selected from said plurality of image slices;
 - calculating a shadow cursor position for a location in the three-dimensional image dataset, the shadow cursor position corresponding to the user cursor position and the calculating including a correction for the magnification factor corresponding to the shadow cursor position for the slice of interest; and
 - outputting the shadow cursor position.
2. (original) The method of claim 1, further comprising displaying the two-dimensional image dataset on a display device and displaying the slice of interest adjacent to the two-dimensional image dataset on the display device.

3. (original) The method of claim 2, further comprising:
displaying a user arrow at the user cursor position on the two-dimensional image dataset; and
displaying a shadow arrow at the shadow cursor position on the slice of interest.

4. (original) The method of claim 1, wherein the two-dimensional image dataset is acquired using an x-ray source and a detector.

5. (original) The method of claim 1, wherein the three-dimensional dataset is acquired using an ultrasound probe.

6. (original) The method of claim 1, wherein said registering is performed during data acquisition.

7. (original) The method of claim 1, wherein said registering includes mechanical registration.

8. (original) The method of claim 1, wherein said registering includes longitudinal registration.

9. (original) The method of claim 1, wherein:
the three-dimensional image dataset includes ultrasound data;
the two-dimensional image data set includes x-ray data; and
the correction for the magnification factor for the slice of interest is derived in accordance with the expression:

$$t = (Z_u - Z_s) / (Z_x - Z_s)$$

where Z_u is a z coordinate of the slice of interest, Z_s is a z coordinate of an x-ray source location and Z_x is a z coordinate of the user cursor position.

10. (original) The method of claim 1, wherein:

the three-dimensional image dataset includes ultrasound data;

the two-dimensional image data set includes x-ray data; and

the calculating is performed in accordance the expressions:

$$X_u = X_s + (X_x - X_s)(t) \text{ and } Y_u = Y_s + (Y_x - Y_s)(t)$$

where X_u is a x coordinate of the shadow cursor position, X_s is a x coordinate of an x-ray source location, X_x is a x coordinate of the user cursor position, t is the correction for the magnification factor, Y_u is a y coordinate of the shadow cursor position, Y_s is a y coordinate of an x-ray source location and Y_x is a y coordinate of the user cursor position.

11. (original) The method of claim 1, wherein:

the three-dimensional image dataset includes ultrasound data;

the two-dimensional image data set includes x-ray data; and

the calculating is performed in accordance the expressions:

$$X_u = X_s + (X_x - X_s)(Z_u - Z_s)/(Z_x - Z_s) \text{ and}$$

$$Y_u = Y_s + (Y_x - Y_s)(Z_u - Z_s)/(Z_x - Z_s)$$

where X_u is a x coordinate of the shadow cursor position, X_s is a x coordinate of an x-ray source location, X_x is a x coordinate of the user cursor position, Y_u is a y coordinate of the shadow cursor position, Y_s is a y coordinate of an x-ray source location, Y_x is a y coordinate of the user cursor position, Z_u is a z coordinate of the slice of interest, Z_s is a z coordinate of an x-ray source location and Z_x is a z coordinate of the user cursor position.

12. (original) A method for multi-modality registration using virtual cursors, the method comprising:

receiving a two-dimensional image dataset for an object at a first position;

receiving a three-dimensional image dataset for the object at the first position, said three-dimensional image dataset including a plurality of image slices;

registering the two-dimensional image dataset with the three-dimensional image dataset without taking into account a magnification factor;

receiving a slice of interest in said three-dimensional image dataset, said slice of interest selected from said plurality of image slices;

receiving a user cursor position for a location in the slice of interest in said three-dimensional image dataset;

calculating a shadow cursor position for a location in the two-dimensional image dataset, the shadow cursor position corresponding to the user cursor position and the calculating including a correction for the magnification factor corresponding to the shadow cursor position; and

outputting the shadow cursor position.

13. (original) A system for multi-modality registration using virtual cursors, the system comprising:

a computer system in communication with a first imaging system and a second imaging system, wherein said first imaging system creates a two-dimensional image dataset for an object at a first position, said second imaging system creates a three-dimensional image dataset of the object at the first position, said three-dimensional image dataset including a plurality of image slices, and said computer system includes instructions to implement a method comprising:

receiving the two-dimensional image dataset from the first imaging system;

receiving the three-dimensional image dataset from the second imaging system;

registering the two-dimensional image dataset with the three-dimensional image dataset without taking into account a magnification factor;

receiving a user cursor position for a location in the two-dimensional image dataset;

receiving a slice of interest in the three-dimensional dataset, said slice of interest selected from the plurality of image slices;

calculating a shadow cursor position for a location in the two-dimensional image dataset, the shadow cursor position corresponding to the user cursor position and the calculating including a correction for the magnification factor corresponding to the shadow cursor position; and
outputting the shadow cursor position.

14. (original) The system of claim 13 wherein the first imaging system is an x-ray imaging system.

15. (original) The system of claim 14 wherein said x-ray imaging system includes an x-ray source and detector.

16. (original) The system of claim 13 wherein the second imaging system is an ultrasound imaging system.

17. (original) The system of claim 16 wherein said ultrasound imaging system includes an ultrasound probe.

18. (original) The system of claim 13 further comprising a display device in communication with the computer system, wherein said user cursor position is received from said display device.

19. (original) The system of claim 18 wherein said method further comprises displaying the two-dimensional image dataset and the slice of interest adjacent to the two-dimensional dataset on the display device.

20. (original) A computer program product for multi-modality registration using virtual cursors, the product comprising:

a storage medium readable by a processing circuit and storing instructions for execution by the processing circuit for performing a method comprising:

receiving a two-dimensional image dataset for an object at a first position;

receiving a three-dimensional image dataset for the object at the first position, said three-dimensional dataset including a plurality of image slices;

registering the two-dimensional image dataset with the three-dimensional image dataset without taking into account a magnification factor;

receiving a user cursor position for a location in the two-dimensional image dataset;

receiving a slice of interest in said three-dimensional image dataset, said slice of interest selected from said plurality of image slices;

calculating a shadow cursor position for a location in the three-dimensional image dataset, the shadow cursor position corresponding to the user cursor position and the calculating including a correction for the magnification factor corresponding to the shadow cursor position for the slice of interest; and

outputting the shadow cursor position.